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Takeuchi et al.

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(54) **LIQUID EJECTING APPARATUS**

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PCT Pub. Date: **Sep. 6, 2013**

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B41J 13/10	(2006.01)
B41J 29/13	(2006.01)
B41J 11/00	(2006.01)

(52) **U.S. Cl.**

CPC ***B41J 2/17523*** (2013.01); ***B41J 2/175*** (2013.01); ***B41J 2/17509*** (2013.01); ***B41J 11/0045*** (2013.01); ***B41J 13/106*** (2013.01); ***B41J 29/02*** (2013.01); ***B41J 29/13*** (2013.01)

(58) **Field of Classification Search**

USPC 347/85

See application file for complete search history.

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(57) **ABSTRACT**

An arrangement path of a tube arranged between an ink tank and a carriage is optimized in a case where the ink tank is arranged in an outer portion or the like of an ink jet printer main body.

A liquid ejecting apparatus **1** includes a liquid ejecting apparatus main body **2** that ejects a liquid from a liquid ejecting head which is mounted on a carriage, a liquid accommodating body **110** that is arranged in an external area or the like of the liquid ejecting apparatus main body **2**, and liquid supply tubes **120** that are arranged between the liquid accommodating body **110** and the carriage. The liquid ejecting apparatus further includes a paper discharge frame that is arranged along a scanning direction of the liquid ejecting head on a further forward side than the liquid ejecting head. A part of the liquid supply tubes **120** is fixed to a frame member paper discharge frame.

16 Claims, 11 Drawing Sheets

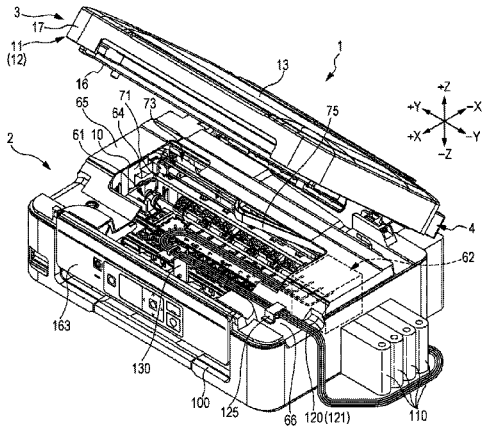
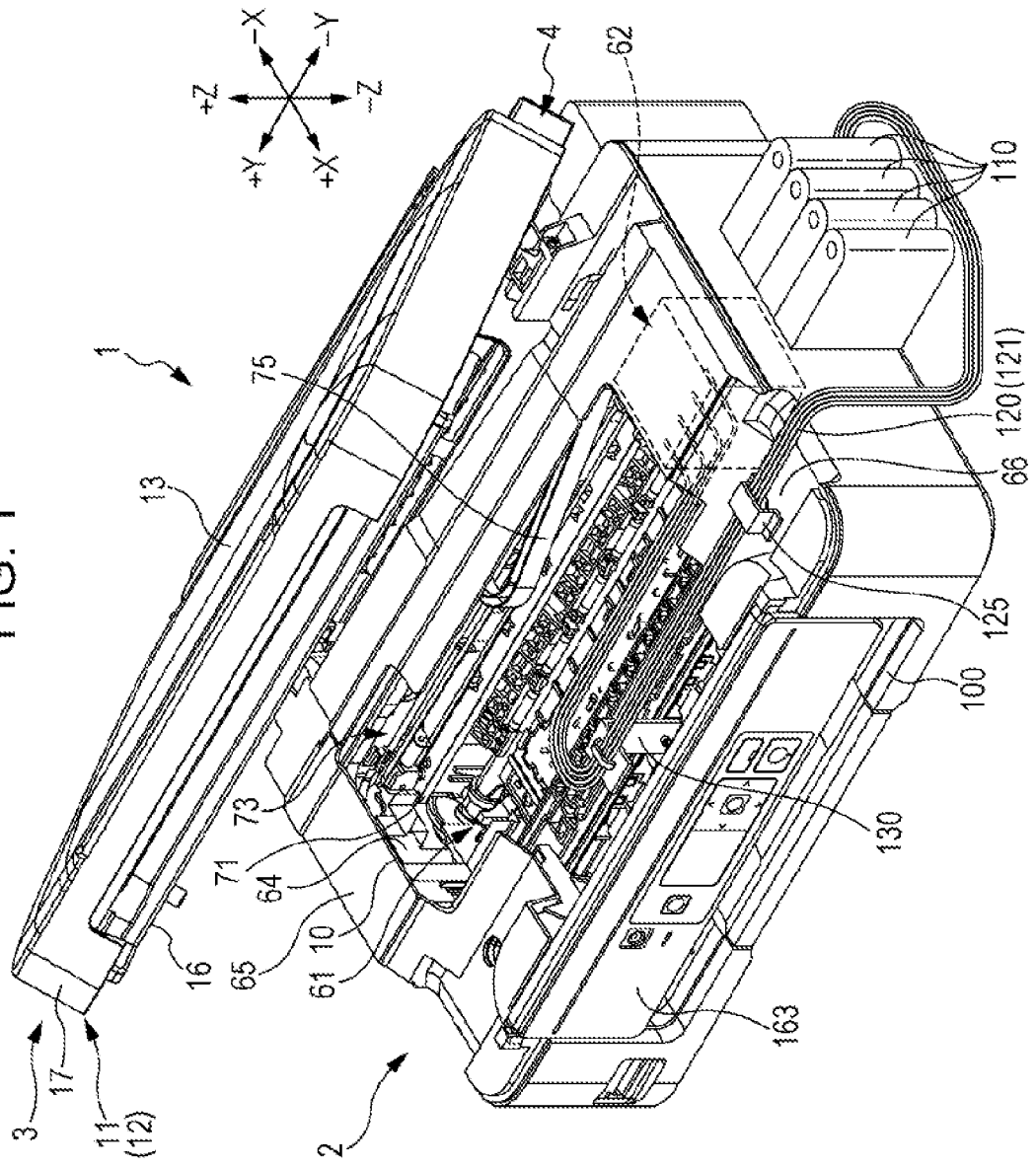


FIG. 1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-X
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-Z
+Y
+X
4
62
110
1
75
120(121)
13
66
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130
73
71
64
10
16
65
61
163
3
17
11
(12)
2

FIG. 2

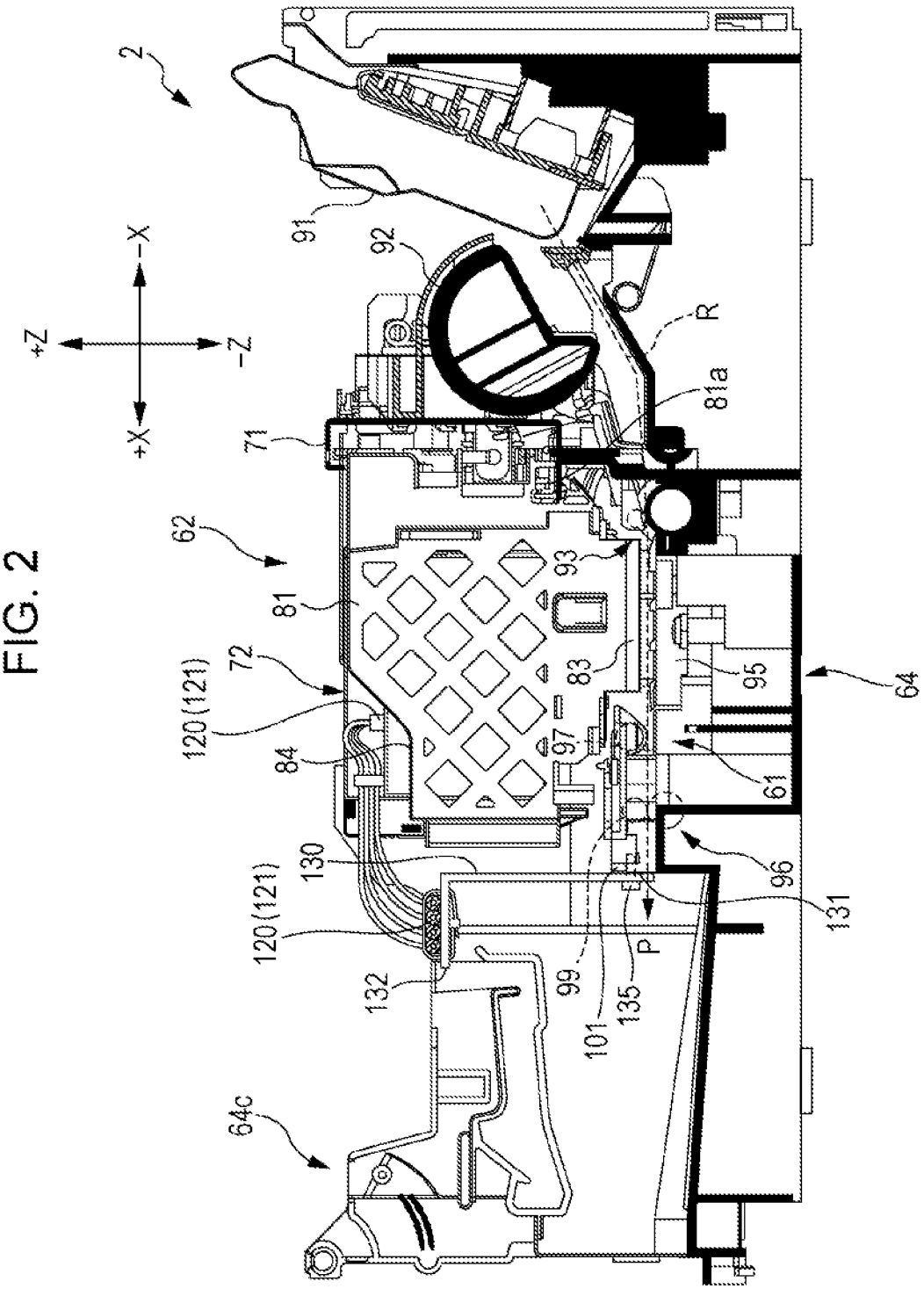
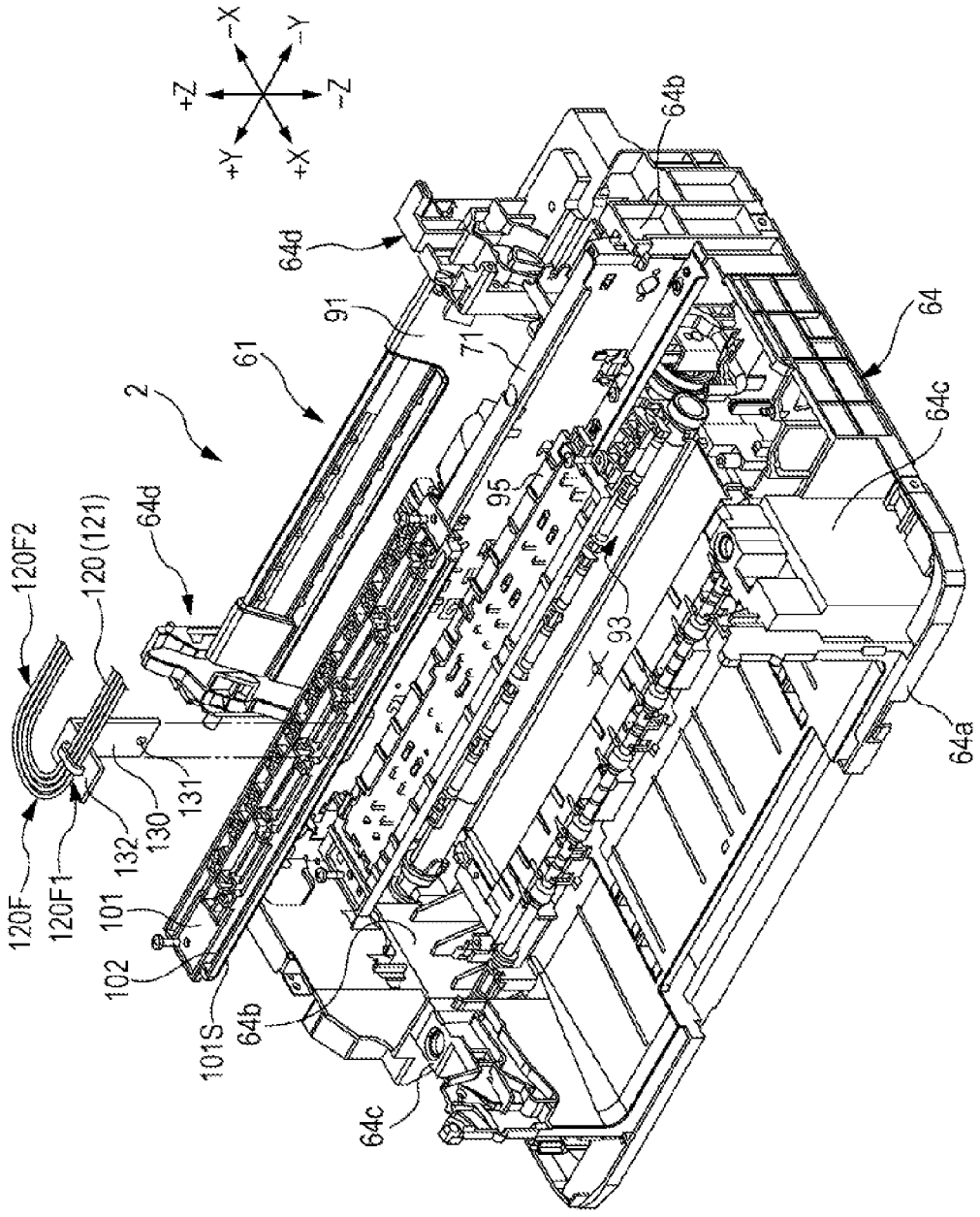

2
91
92
R
81a
71
62
81
93
72
120(121)
84
83
95
64
97
61
130
96
120(121)
131
P
132
99
101
135
64c
+Z
-Z
+X
-X

FIG. 3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-Z
+Y
-Y
+X
-X
64d
64b
91
71
61
2
64
64c
95
93
64a
120F2
120(121)
64d
131
130
132
120F
120F1
101
102
101S
64b
64c

FIG. 4

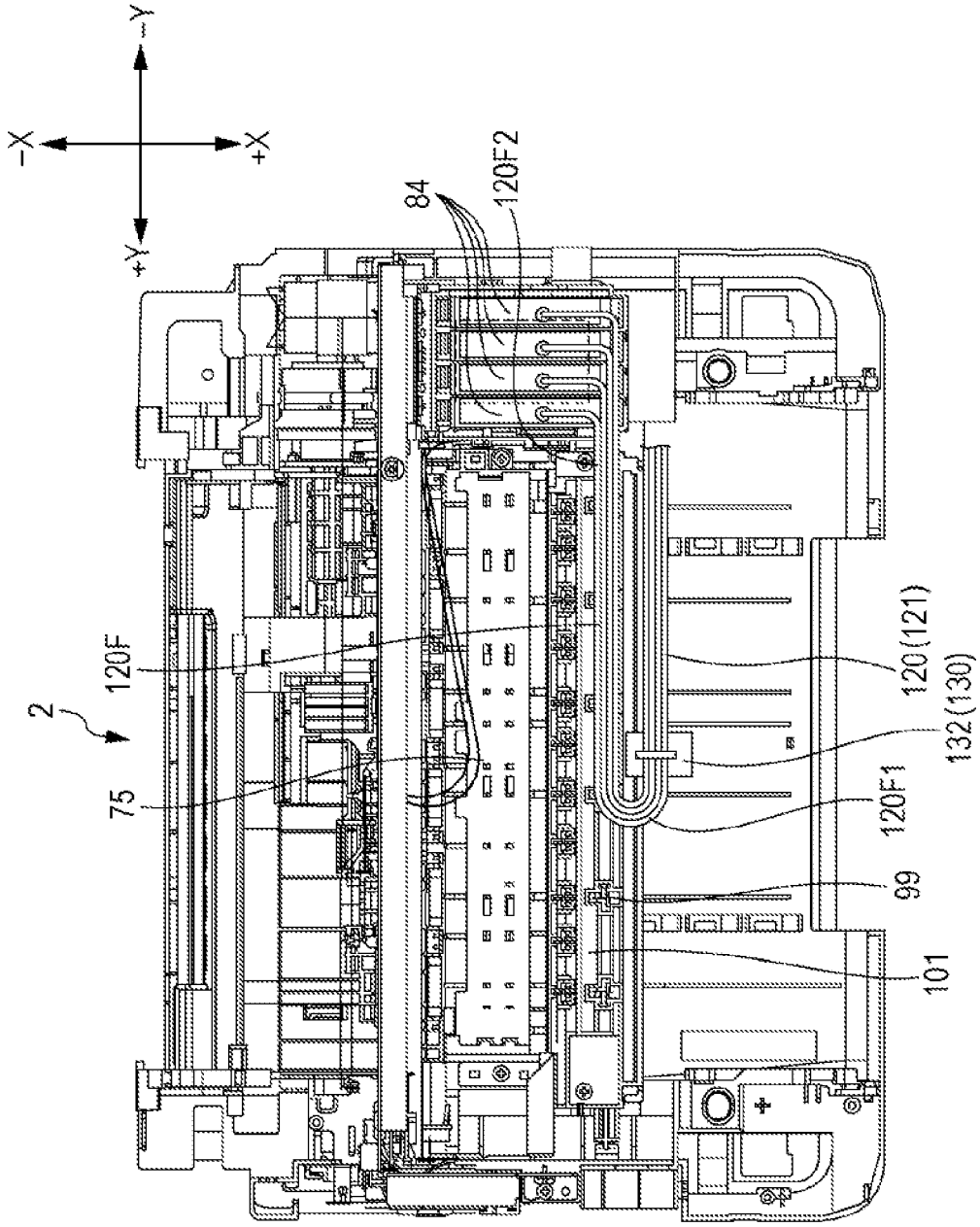


FIG. 5

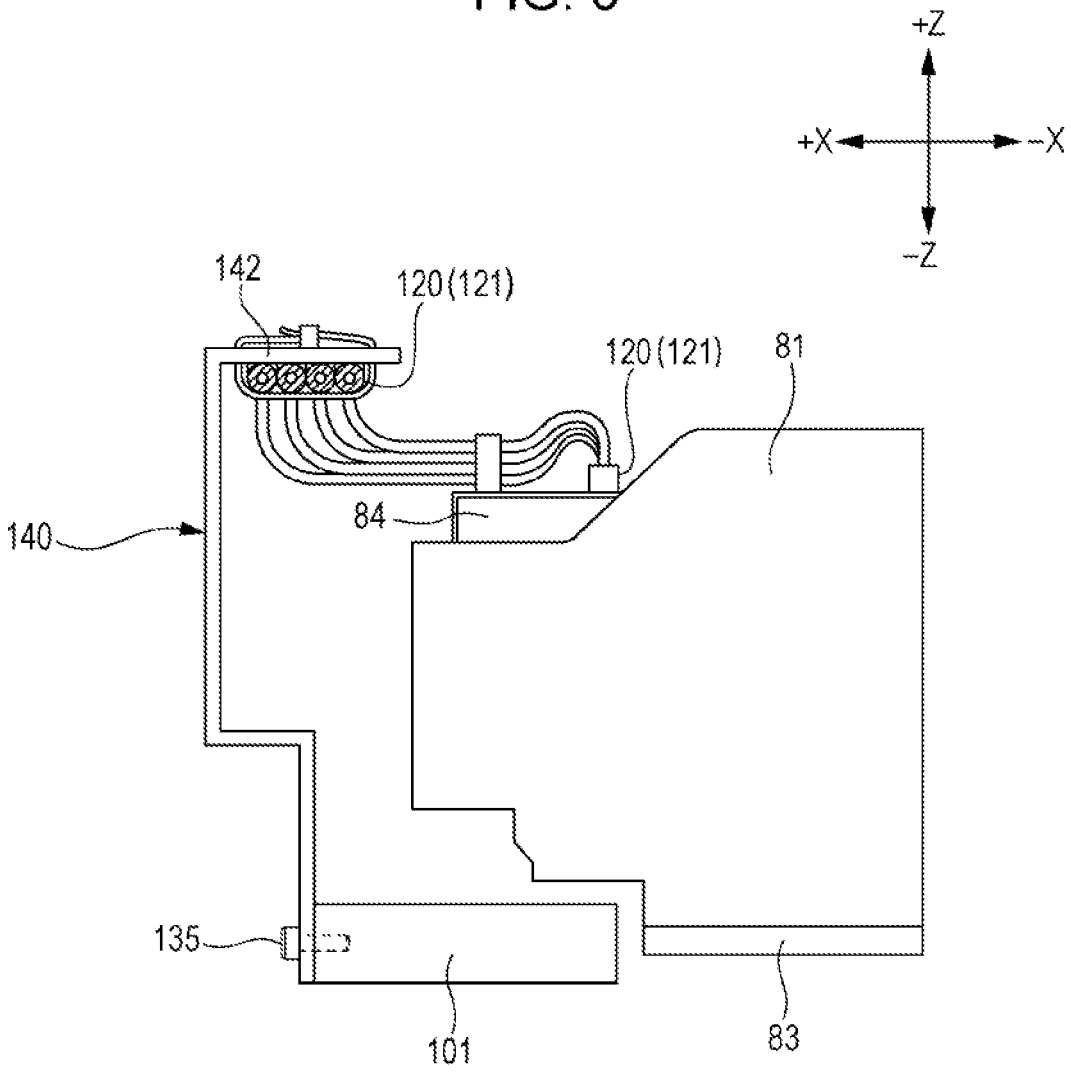


FIG. 6

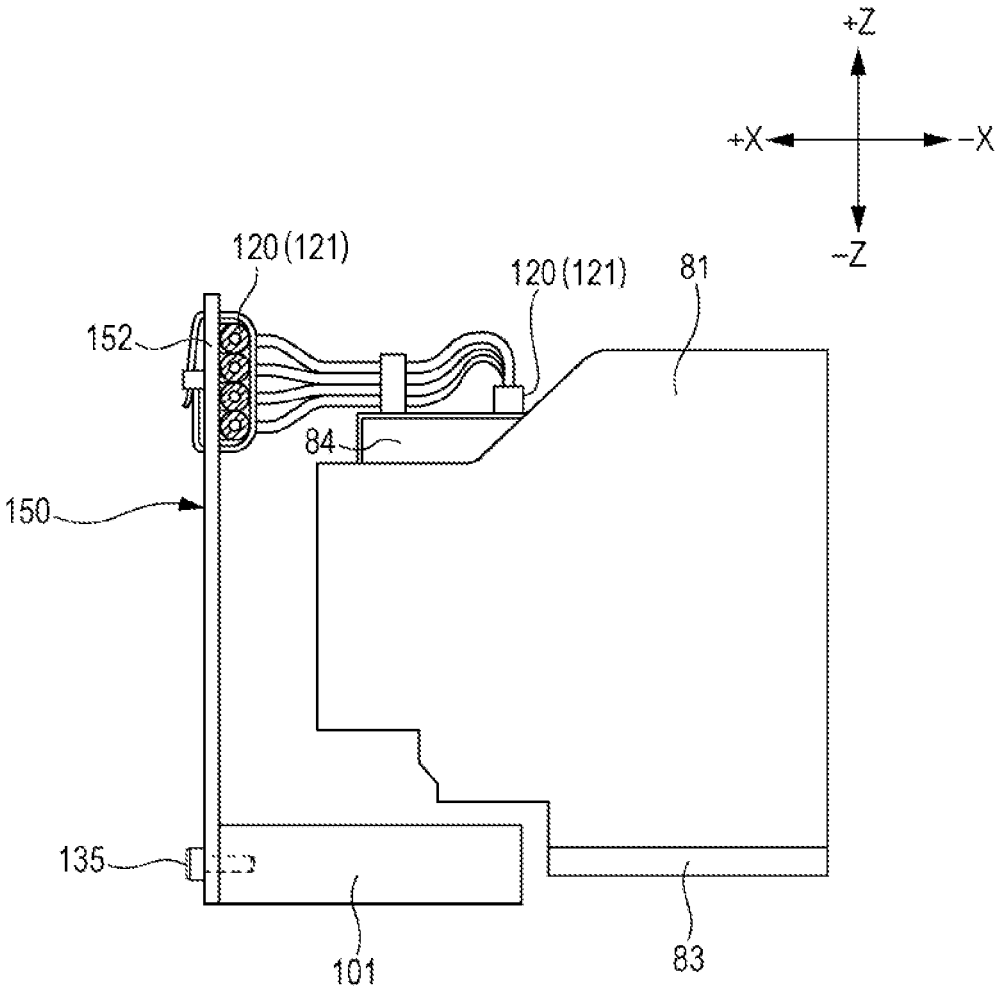


FIG. 7

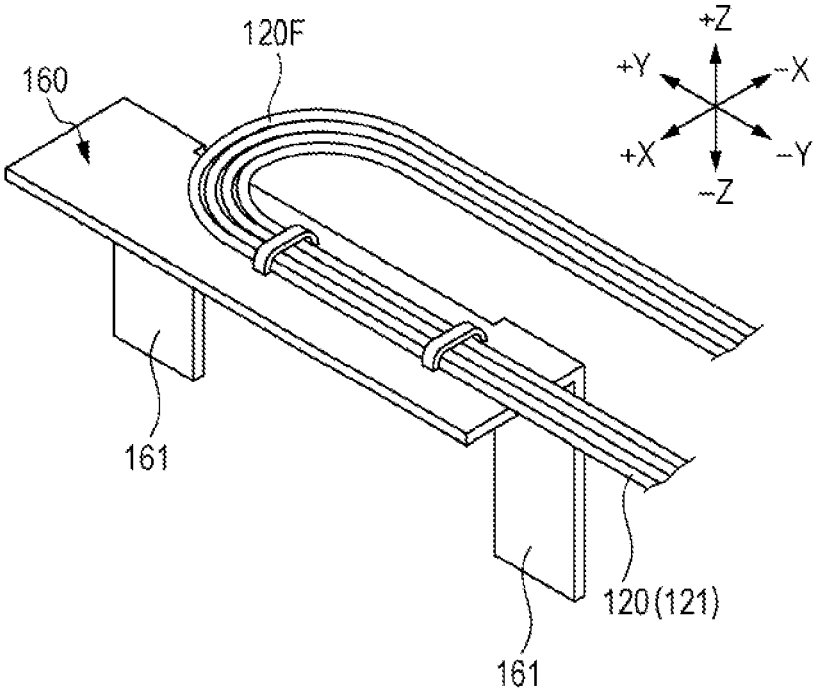

120F
160
+Z
+Y
-X
+X
-Y
-Z
161
120(121)
161

FIG. 8

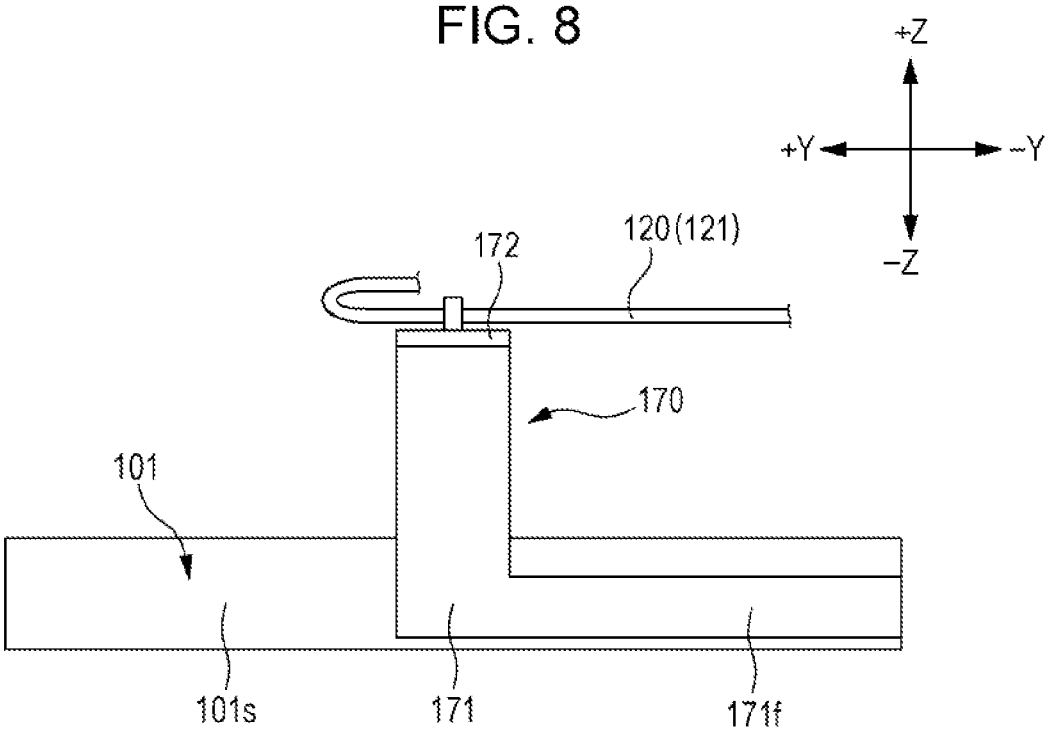

+Z
+Y
-Y
-Z
172
120(121)
170
101
101s
171
171f

FIG. 9

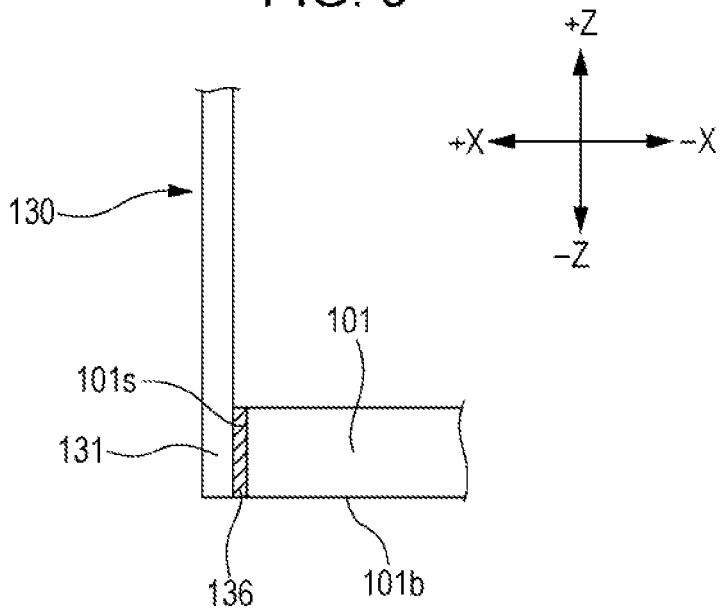
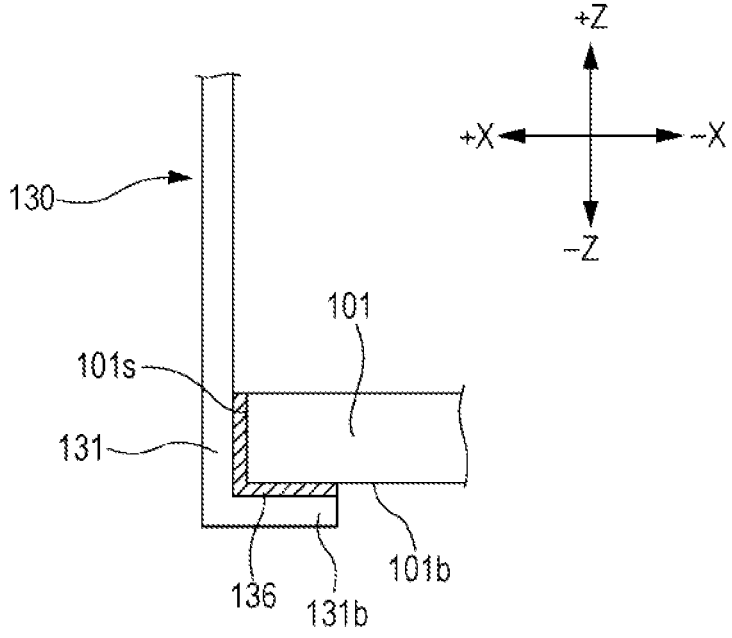

+Z
+X
-X
-Z
130
101
101s
131
136
101b

FIG. 10


+Z
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-X
-Z
130
101
101s
131
136
131b
101b

FIG. 11

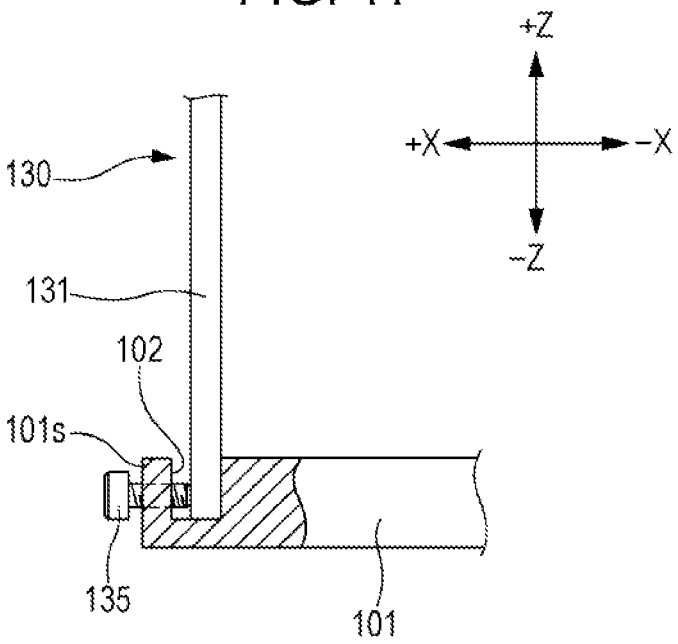


FIG. 12

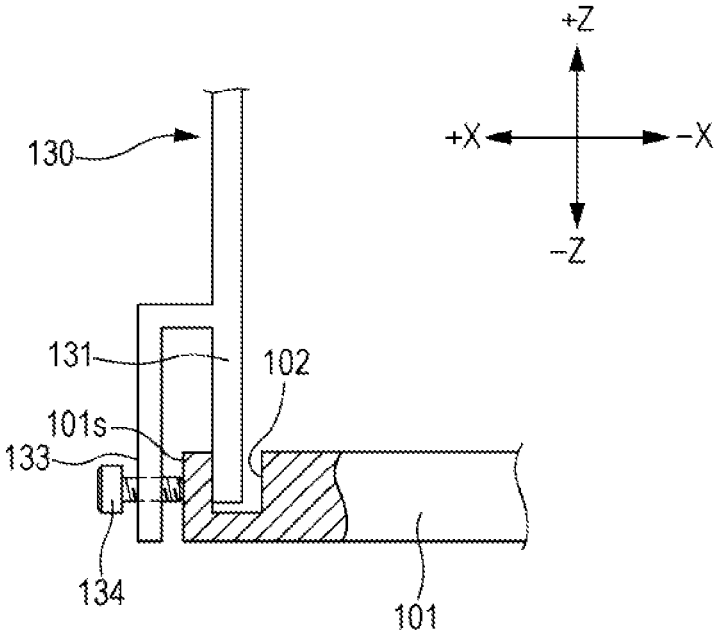
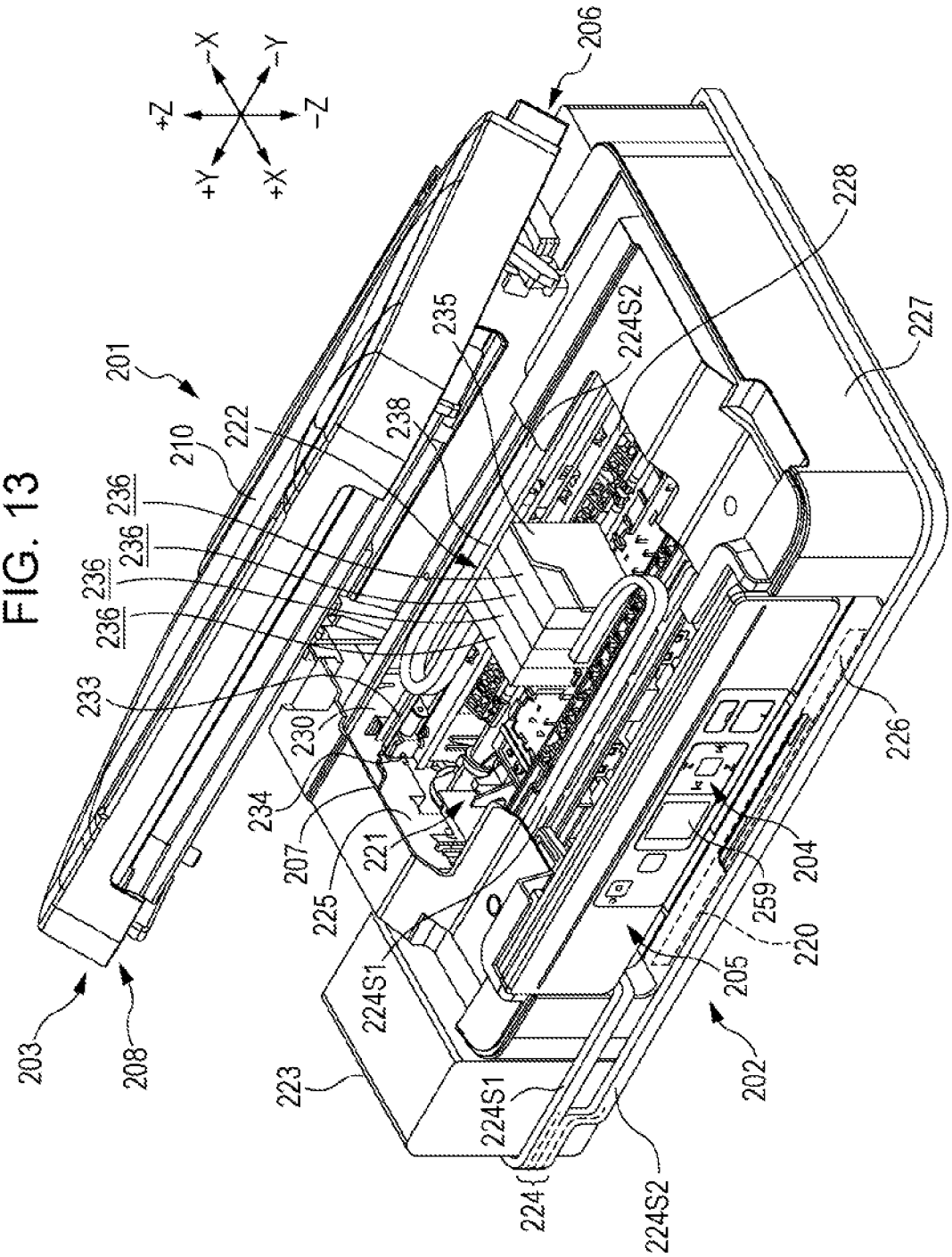


FIG. 13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-Y
-Z
+Y
+X
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228
227
201
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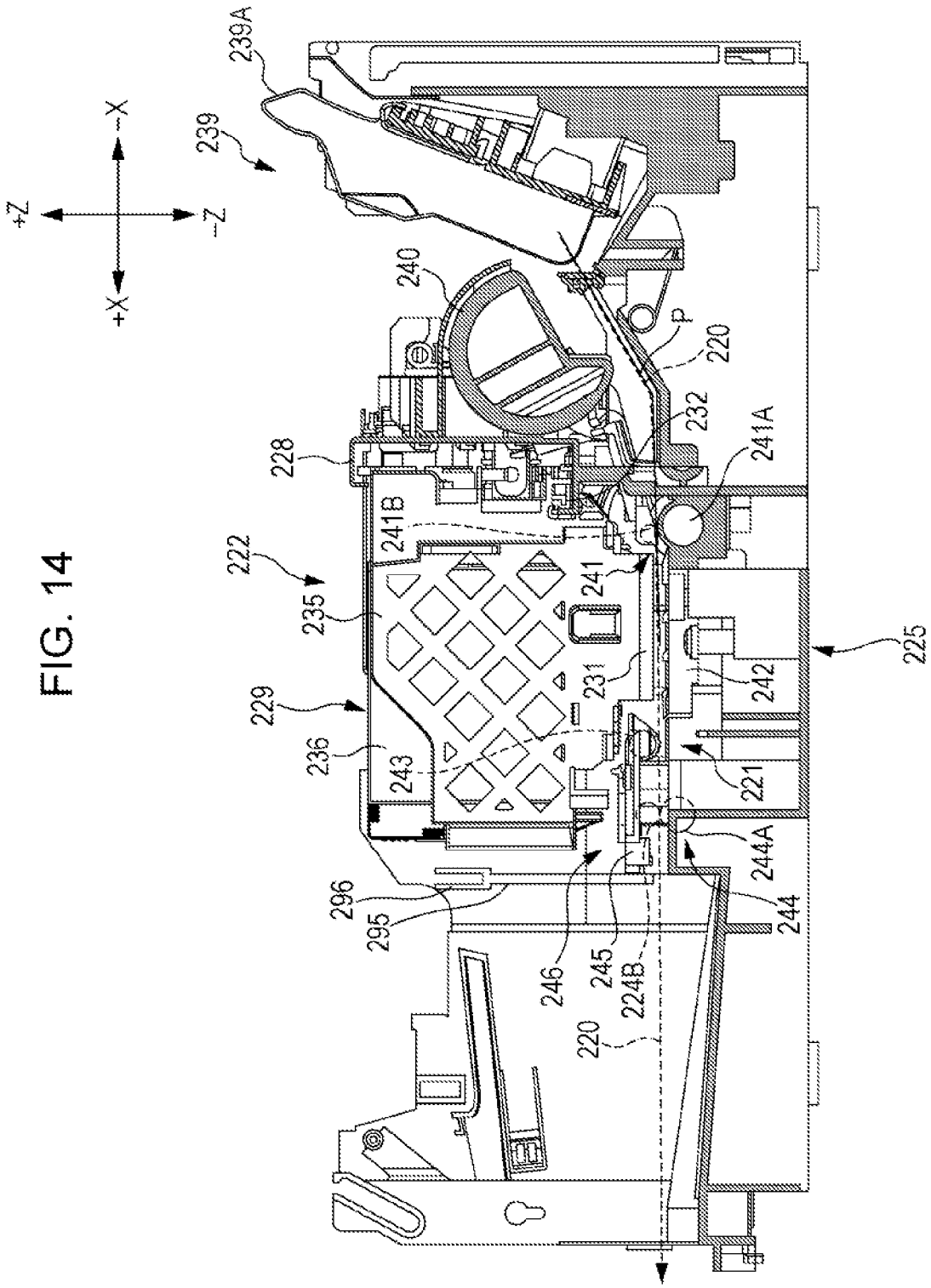
224S2
222
238
210
236
236
236
236
233
230
234
207
221
225
224S1
223
224
224S2
226
204
259
220
205
202
203
208

FIG. 14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221
244A
296
295
244
246
245
224B
220
+Z
-Z
+X
-X

LIQUID EJECTING APPARATUS

TECHNICAL FIELD

The present invention relates to a liquid ejecting apparatus that ejects a liquid from a liquid ejecting head which is mounted on a carriage toward a recording medium.

BACKGROUND ART

An ink jet printer is widely known as a liquid ejecting apparatus that ejects a liquid from a liquid ejecting head to a recording medium.

The ink jet printer includes a carriage, and a recording head that is mounted on the carriage. Printing is performed on recording paper when ink (liquid) is ejected from a nozzle formed on the recording head while the carriage is in a scanning movement with respect to the recording paper (recording medium).

In some ink jet printers, an ink cartridge that supplies the ink to the recording head is mounted on the carriage (on carriage type). The ink cartridge is detachably mounted on the carriage.

In the on carriage type ink jet printer, the ink capacity of the ink cartridge is limited. In a case where relatively voluminous printing is to be performed, the ink cartridges have to be frequently exchanged, which results in an increase in running cost.

An apparatus that supplies the ink from a large ink tank, which is arranged out of the ink jet printer, toward the carriage has been proposed. An attachment, instead of the ink cartridge, is mounted on the carriage. The ink is supplied from the ink tank to the attachment via a tube. The voluminous printing is possible in this manner (refer to PTL 1).

CITATION LIST

Patent Literature

PTL 1: Specification of Chinese Examined Utility Model Registration Application Publication No. 2825289

SUMMARY OF INVENTION

Technical Problem

According to the technique described in PTL 1, the large ink tank is arranged on a side in an outer portion of an ink jet printer main body. The tube is laid across the carriage from a side portion of the ink jet printer main body. A part of the tube is fixed to a tube holding member that is mounted on the ink jet printer main body.

The tube holding member is fixed on a paper feed unit side of the ink jet printer main body. Accordingly, when the carriage is in the scanning movement, a flexible cable or the like that is laid across the carriage from the paper feed unit side of the ink jet printer main body and the tube may interfere with each other.

An object of the invention is to optimize an arrangement path of the tube arranged between the ink tank and the carriage in a case where the ink tank is arranged in the outer portion or the like of the ink jet printer main body.

Solution to Problem

According to the invention, there is provided a liquid ejecting apparatus including a liquid ejecting apparatus main body

that ejects a liquid from a liquid ejecting head which is mounted on a carriage toward a recording medium, a liquid accommodating body that is arranged in an external area of the liquid ejecting apparatus main body, and a plurality of liquid supply tubes that guide the liquid which is fed from the liquid accommodating body where the liquid is accommodated toward the liquid ejecting head and include a deforming movable portion which is deformed in response to the movement of the carriage, in which the liquid ejecting apparatus further includes a paper discharge frame that is arranged along a scanning direction of the liquid ejecting head on a further downstream side of the recording medium in a transport direction than the liquid ejecting head, a part of the liquid supply tubes is fixed to the paper discharge frame, and the liquid supply tubes are deformed in response to the movement of the carriage.

According to the invention, the liquid ejecting apparatus further includes a tube holding member with a base end portion fixed to the paper discharge frame and a tip end portion where a part of the liquid supply tubes is held.

The liquid supply tubes are formed from a plurality of tubes, and the liquid supply tubes are arranged in a horizontal direction and fastened by the tip end portion.

The liquid supply tubes are formed from a plurality of tubes, and the liquid supply tubes are arranged in a perpendicular direction and fastened by the tip end portion.

The liquid supply tubes are parallel connection tubes where the plurality of tubes are connected in parallel.

The tip end portion of the tube holding member is formed in parallel with the paper discharge frame.

The base end portion of the tube holding member has an extending site along the paper discharge frame, and the extending site coincides with an end portion of the paper discharge frame.

The paper discharge frame further includes a bottom surface that faces the recording medium and a front surface toward the downstream side in the transport direction, and the base end portion of the tube holding member is formed to be shaped to be fixed in close contact to the bottom surface and the front surface of the paper discharge frame.

The paper discharge frame further includes a front surface toward the downstream side in the transport direction, and the base end portion of the tube holding member is formed into a flat plate shape to be fixed in close contact only to the front surface of the paper discharge frame.

The paper discharge frame further includes a groove portion with an open upper surface, and the base end portion of the tube holding member is accommodated in the groove portion to be movable in the scanning direction.

The base end portion of the tube holding member is pressed against the groove portion and is fixed to the paper discharge frame by a screw which is mounted on the groove portion.

The liquid ejecting apparatus further includes an internal space on the further downstream side of the recording medium in the transport direction than the paper discharge frame.

The liquid supply tubes are outward from a concave portion that is formed in an upper surface of the liquid ejecting apparatus.

The tube holding member is mounted on the concave portion.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is an external perspective view of a multifunction printer **1** (at a time when a scanner unit **3** is in an open state) according to a first embodiment.

FIG. **2** is a side sectional view illustrating an internal structure of a printer unit **2** and an arrangement path of a tube **120**.

FIG. **3** is an exploded perspective view illustrating the internal structure of the printer unit **2** and the arrangement path of the tube **120**.

FIG. **4** is a top view illustrating the internal structure of the printer unit **2** and the arrangement path of the tube **120**.

FIG. **5** is a view illustrating a tube holding member **140**.

FIG. **6** is a view illustrating a tube holding member **150**.

FIG. **7** is a view illustrating a tube holding member **160**.

FIG. **8** is a view illustrating a tube holding member **170**.

FIG. **9** is a view illustrating a first modification example of a base end portion **131** of a tube holding member **130**.

FIG. **10** is a view illustrating a second modification example of the base end portion **131** of the tube holding member **130**.

FIG. **11** is a view illustrating a third modification example of the base end portion **131** of the tube holding member **130**.

FIG. **12** is a view illustrating a fourth modification example of the base end portion **131** of the tube holding member **130**.

FIG. **13** is an external perspective view of a multifunction printer (at a time when a scanner unit **203** is in an open state) according to a second embodiment.

FIG. **14** is a side sectional view illustrating an internal structure of a printer unit **202**.

DESCRIPTION OF EMBODIMENTS

First Embodiment

A multifunction printer **1** according to a first embodiment of the invention will be described.

Hereinafter, in each of the accompanying drawings, a transport direction (vertical scanning) of recording paper P is referred to as an X direction, a scanning direction (horizontal direction) of a carriage **81** is referred to as a Y direction, and a perpendicular direction is referred to as a Z direction.

Idiomatically, a downstream side (+X direction) of the recording paper (recording medium) P in the transport direction is referred to as front, and an upstream side (−X direction) is referred to as back. In the Y direction, a +Y direction is referred to as a left side, and a −Y direction is referred to as a right side. In the Z direction, a +Z direction is referred to as up, and a −Z direction is referred to as down.

FIG. **1** is an external perspective view of the multifunction printer **1** (at a time when a scanner unit **3** is in an open state) according to the first embodiment.

The multifunction printer (liquid ejecting apparatus) **1** includes a printer unit **2** that is an apparatus main body and the scanner unit **3** that is an upper unit which is arranged in an upper portion of the printer unit **2**, which are integrally provided. As illustrated in FIG. **1**, the multifunction printer **1** includes ink containers (liquid accommodating bodies) **110**, which store ink, in an outer portion of the printer unit **2**.

The scanner unit **3** is rotatably supported by the printer unit **2** via an opening/closing unit **4** in a rear end portion, and covers the upper portion of the printer unit **2** in an openable and closeable manner.

As illustrated in FIG. **1**, an upper surface opening portion **10** of the printer unit **2** is exposed when the scanner unit **3** is lifted in a direction of rotation. In this manner, an inner portion of the printer unit **2** is exposed from the upper surface opening portion **10**.

The upper surface opening portion **10** is closed by the scanner unit **3** when the scanner unit **3** is lowered in the direction of rotation and is mounted on the printer unit **2**.

Prevention of paper jamming or the like is possible when the scanner unit **3** is lifted and the upper surface opening portion **10** is exposed in this manner.

The scanner unit **3** has a resinous upper frame **11**, an image reading unit **12** that is accommodated in the upper frame **11**, and an upper lid **13** that is rotatably supported by an upper portion of the upper frame **11**.

The component of the opening/closing unit **4** on the scanner unit **3** side is disposed in a rear end portion of the upper frame **11**.

The upper frame **11** has a box-shaped lower case **16** that accommodates the image reading unit **12**, and an upper case **17** that covers a top surface of the lower case **16**.

A manuscript mounting plate formed of glass is widely arranged (not illustrated) in the upper case **17**. A reading medium is mounted, with a reading surface facing downward, on the manuscript mounting plate.

The image reading unit **12** that is accommodated in the lower case **16** has a line sensor type sensor unit or the like (not illustrated). The sensor unit has an image sensor (sensor unit) that is a charge coupled device (CCD) type line sensor extending in the X direction, and reciprocates in the Y direction. In this manner, an image of the reading medium (manuscript) on the manuscript mounting plate is read.

A complementary metal oxide semiconductor (CMOS) type line sensor may be used as the image sensor.

The printer unit (liquid ejecting apparatus main body) **2** has a transport unit **61** that feeds a sheet of the recording paper P along a transport path R, a printing unit **62** that is arranged above the transport path R and performs ink jet type printing processing on the recording paper P, a panel type operation unit **63** that is arranged on a front surface, an apparatus frame **64** on which the transport unit **61**, the printing unit **62**, and the operation unit **63** are mounted, and an apparatus housing **65** that covers the transport unit **61**, the printing unit **62**, the operation unit **63**, and the apparatus frame **64**.

FIG. **2** is a side sectional view illustrating an internal structure of the printer unit **2** and an arrangement path of a tube **120**.

The printing unit **62** has a guide frame **71** formed of sheet metal that is supported by the apparatus frame **64** and extends in full width in the Y direction, a carriage unit **72** that is reciprocally supported by the guide frame **71**, and a carriage moving mechanism **73** (refer to FIG. **1**) that allows the carriage unit **72** to reciprocate along the guide frame **71**.

The carriage unit **72** has a box-shaped carriage **81** that is reciprocally supported by the guide frame **71** via an engaging slider portion **81***a*, an ink jet head **83** that is integrally incorporated into a lower surface of the carriage **81**, and four ink cartridge adapters **84** that are detachably accommodated in the carriage **81**.

The ink jet head (liquid ejecting head) **83** has four nozzle columns (not illustrated) that discharge ink droplets of four colors. The four ink cartridge adapters **84** that store the ink of the four colors are mounted on the carriage **81**. The four ink cartridge adapters **84** are directly connected to an upper surface side to the ink jet head **83**.

The ink is supplied to the ink cartridge adapters **84** from the ink containers **110** (described later).

The transport unit **61** has a movable paper tray **91** that sets the recording paper P in right alignment, a separation roller **92** that feeds out the recording paper P by separating the recording paper P sheet by sheet from the paper tray **91**, a paper feed roller **93** that is positioned on the downstream side of the separation roller **92** and feeds the recording paper P into the printing unit **62** along the transport path R, a medium regulating member **95** that is positioned on the downstream side of

the paper feed roller **93** and faces the ink jet head **83**, a serrated guide roller **97** that is positioned on the downstream side of the medium regulating member **95**, and a paper discharge roller **96** that is positioned on the downstream side of the guide roller **97** and feeds out the recording paper P from an outlet **100** (refer to FIG. **1**).

The medium regulating member **95** corresponds to a so-called platen.

The recording paper P that is fed in from the paper tray **91** by the separation roller **92** is intermittently fed in the X direction toward the paper discharge roller **96** on the medium regulating member **95** by the paper feed roller **93** (vertical scanning).

In synchronization with this intermittent feeding, the carriage unit **72** selectively discharges the ink while reciprocating in the X direction (main scanning) to perform desired printing.

A leading edge of the recording paper P that reaches the guide roller **97** beyond the medium regulating member **95** is fed into the paper discharge roller **96** with a cambered state corrected by the guide roller **97**.

When the printing is completed, the recording paper P is fed out forward from the outlet **100** by the paper discharge roller **96** in this manner.

FIG. **3** is an exploded perspective view illustrating the internal structure of the printer unit **2** and the arrangement path of the tube **120**.

FIG. **4** is a top view illustrating the internal structure of the printer unit **2** and the arrangement path of the tube **120**.

The apparatus frame **64** is a frame that supports each of the portions of the printer unit **2**, and is formed of an integrally molded resin.

The apparatus frame **64** has a base frame portion **64***a*, a pair of right and left side frame portions **64***b*, a pair of right and left front frame portions **64***c*, and a pair of right and left rear frame portions **64***d*.

The pair of right and left side frame portions **64***b* are disposed upright in the base frame portion **64***a*, and support each of the components of the transport unit **61** and the guide frame **71** on both sides.

The pair of right and left front frame portions **64***c* support a front portion of the scanner unit **3** in a front portion of the base frame portion **64***a*, and support the operation unit **63**.

The pair of right and left rear frame portions **64***d* support the printer unit **2** in an openable and closeable manner via the opening/closing unit **4** in a rear portion of the base frame portion **64***a*.

The pair of rear frame portions **64***d* are disposed upright to an outer portion of the apparatus housing **65** via a rear portion opening portion that is open to a rear portion of the apparatus housing **65**. The component of the opening/closing unit **4** on the printer unit **2** side is formed in the pair of rear frame portions **64***d*.

A paper discharge frame **101** that supports the guide roller **97** and an auxiliary roller **99** is arranged in front portions of the side frame portions **64***b*. The auxiliary roller (roller) **99** is arranged to face the paper discharge roller **96**.

The paper discharge frame (paper discharge frame) **101** is arranged on a more frontward (+X direction) side and on a more downward (−Z direction) side than the carriage **81**. The paper discharge frame **101** is laid across horizontally along the scanning direction (Y direction) of the carriage **81** between the pair of side frame portions **64***b*.

The four ink containers **110** that store the ink of the four colors are arranged on a side surface side (−Y direction) of the multifunction printer **1** (refer to FIG. **1**). The ink accommodation amount of the ink containers **110** is larger than the ink accommodation amount of the ink cartridge adapters **84**.

The tube **120**, through which the ink that is accommodated in the ink containers **110** is supplied toward the ink cartridge adapters **84**, is arranged (piped) between the ink containers **110** and the ink cartridge adapters **84**. The tube (liquid supply tube) **120** is formed from four tubes **121** through which the ink of the four colors is supplied.

The tube **120** is fixed to the two places of an upper surface of the printer unit **2** and a tube holding member **130** mounted on the paper discharge frame **101** between the ink containers **110** and the ink cartridge adapters **84**.

An area of the tube **120** between the tube holding member **130** and the ink cartridge adapters **84** is a movable area **120**F that is bent and deformed due to a scanning movement of the carriage **81**.

The tube holding member **130** is a flat plate-shaped member that extends in an up-and-down direction, and is formed, for example, by bending a sheet metal (refer to FIG. **3**).

A base end portion **131** that is a lower side end portion of the tube holding member **130** is fixed, by using a screw **135**, to a front surface **101***s* of the paper discharge frame **101**. A tip end portion **132** that is an upper side end portion of the tube holding member **130** is bent and formed on a horizontal plane.

The tube holding member **130** is arranged at the center of the transport unit **61** in a right-and-left direction. A position of the tip end portion **132** in the Z direction is positioned below (−Z direction) an upper end of the carriage **81**. The tube **120** that is formed from the four tubes **121** is held on an upper surface of the tip end portion **132**. The four tubes **121** are fastened and held to be parallel in the X direction in the tip end portion **132**.

The arrangement path (piping route) of the tube **120** will be described along a direction (direction in which the ink flows) from the ink containers **110** toward the ink cartridge adapters **84** (description will be made in the order of FIG. **1** and FIG. **4**).

First, as illustrated in FIG. **1**, the tube **120** is laid across to be an arc-shaped path from the ink containers **110** toward an upper surface of the apparatus housing **65**. A groove-shaped concave portion **66** that has a groove shape is formed along the Y direction on the upper surface of the apparatus housing **65**. The tube **120** is fixed in the groove-shaped concave portion **66** by using a tube fastening/fixing tool **125**.

The tube fastening/fixing tool **125** is a member that fastens and fixes all of the four tubes **121**, which are arranged in parallel in the groove-shaped concave portion **66**, by covering the four tubes **121** from the upper surface side. The tube fastening/fixing tool **125** is formed of a hard resin.

The tube fastening/fixing tool **125** functions such that the tube **120** is not crushed by the scanner unit **3** when the scanner unit **3** is closed. Accordingly, the scanner unit **3** abuts against the tube fastening/fixing tool **125**, and thus the scanner unit **3** cannot be closed completely.

Next, as illustrated in FIG. **1**, the tube **120** is fixed in the groove-shaped concave portion **66** of the apparatus housing **65** and then is laid across toward the tube holding member **130** from the upper surface opening portion **10**. Between the groove-shaped concave portion **66** of the apparatus housing **65** and the tip end portion **132** of the tube holding member **130**, the tube **120** is laid across to be a substantially linear path toward the Y direction.

The tube **120** is held in the tip end portion **132** of the tube holding member **130** at the center of the transport unit **61** in the right-and-left direction. The tube **120** is fastened and fixed, by using a fastening band or the like, in the tip end portion **132** of the tube holding member **130**.

Further, as illustrated in FIG. **4**, the tube **120** is held by the tube holding member **130** and then is arranged, for a moment, toward the +Y direction. Then, the tube **120** is folded back into a U shape and is inverted from the +Y direction into the −Y direction. The tube **120** is folded back into the U shape in the up-and-down direction.

The tube **120**, after being inverted into the −Y direction, is fixed onto upper surfaces of the four ink cartridge adapters **84** accommodated in the carriage **81**. The tube **120** is fixed, by using a fastening band or the like, onto the upper surfaces of the ink cartridge adapters **84**. Then, the four tubes **121** of the tube **120** are respectively connected to the ink cartridge adapters **84**.

The area of the tube **120** that is bent into the U shape is the movable area **120**F that is bent and deformed due to the scanning movement of the carriage **81**. As illustrated in FIG. **2**, a fixing side area **120**F**1** of the movable area **120**F that is close to the tube holding member **130** and a moving side area **120**F**2** of the movable area **120**F that is close to the ink cartridge adapters **84** are arranged at substantially the same position or adjacent positions in the X direction. The fixing side area **120**F**1** is arranged on a more downward side (−Z direction) than the moving side area **120**F**2**. The length of the movable area **120**F is adjusted not to inhibit the scanning movement of the carriage **81**.

As described above, the tube **120** that is arranged (piped) between the ink containers **110** disposed on the sides of the multifunction printer **1** and the carriage **81** is set in a path through the more forward (+X direction) side than the carriage **81** in the multifunction printer **1** according to the first embodiment. Accordingly, the tube **120** does not interfere with, for example, the flexible cable **75** that is wired from the backward (−X direction) side of the carriage **81** to the ink jet head **85** of the carriage **81**.

The tube holding member **130** that supports (holds) one end portion of the movable area of the tube **120** is mounted on the paper discharge frame **101** that is arranged on a more +X direction side than the carriage **81**. Accordingly, the tube **120** can be ensured to realize the path through the more +X direction side than the carriage **81**.

The tube **120** may be a parallel connection tube in which four tubes are integrated instead of being the four tubes **121**. The four tubes **121** are not limited to a case where the four tubes **121** are arranged in parallel. For example, the four tubes **121** may be arranged in two rows, each of which has two of the tubes **121**.

The ink containers **110** are not limited to a case where the number of the ink containers **110** is four, and the tube **120** is not limited to a case where the number of the tubes **121** is four. The number of the ink containers **110** may be six, and the number of the tubes **121** of the tube **120** may be six.

A relatively wide space (internal space) is formed between the paper discharge frame **101** and the outlet **100**.

Since the tube holding member **130** is mounted on the paper discharge frame **101**, the space can be used effectively.

[First Modification Example of Tube Holding Member]

FIG. **5** is a view illustrating a tube holding member **140**.

The tube holding member **140** is a modification example of the tube holding member **130**. The tube holding member **140** can be used instead of the tube holding member **130**. The tube holding member **140** has substantially the same shape as the tube holding member **130**.

Unlike in the tube holding member **130**, a position of a tip end portion **142** of the tube holding member **140** in the Z direction is positioned above (+Z direction) the upper end of the carriage **81**.

The tube **120** is held on a lower surface of the tip end portion **142**. The movable area **120**F of the tube **120** is folded back into a U shape in the up-and-down direction. A holding side area **120**F**1** of the movable area **120**F that is close to the tube holding member **130** and the moving side area **120**F**2** of the movable area **120**F that is close to the ink cartridge adapters **84** are arranged at substantially the same position or adjacent positions in the X direction. The holding side area **120**F**1** is arranged on a more upward side (+Z direction) than the moving side area **120**F**2**.

[Second Modification Example of Tube Holding Member]

FIG. **6** is a view illustrating a tube holding member **150**.

The tube holding member **140** is a modification example of the tube holding member **130**. The tube holding member **140** can be used instead of the tube holding member **130**.

Unlike in the tube holding member **130**, a tip end portion **152** of the tube holding member **150** is formed on a vertical plane. A position of the tip end portion **152** in the Z direction is positioned at substantially the same height as the upper end of the carriage **81**.

The tube **120** is held in parallel along a vertical direction in the tip end portion **152**. The movable area **120**F of the tube **120** is folded back into a U shape in the horizontal direction.

The holding side area **120**F**1** of the movable area **120**F that is close to the tube holding member **130** and the moving side area **120**F**2** of the movable area **120**F that is close to the ink cartridge adapters **84** are arranged at substantially the same position or adjacent positions in the Z direction. The holding side area **120**F**1** is arranged on a more forward side (+X direction) than the moving side area **120**F**2**.

[Third Modification Example of Tube Holding Member]

FIG. **7** is a view illustrating a tube holding member **160**.

The tube holding member **160** is a modification example of the tube holding members **130**, **140**, and **150**. The tube holding member **160** can be used instead of the tube holding members **130**, **140**, and **150**.

The tube holding member **160** is formed from two base end portions **161** that are disposed upright in the up-and-down direction, and a tip end portion **162** that is laid across horizontally between the two base end portions **161**. The tube holding member **160** has the beam-shaped tip end portion **162**.

The two base end portions **161** have the same shape as, for example, the base end portion **131** of the tube holding member **130**. The tip end portion **162** is arranged in parallel with the paper discharge frame **101**.

The tip end portion **162** is formed on a horizontal plane as is the case with the tip end portions **132** and **142**. In this case, a position of the tip end portion **162** in the Z direction is set similarly to any one of the tip end portions **132** and **142**.

The tip end portion **162** may be formed on a vertical plane as is the case with the tip end portion **162**. In this case, a position of the tip end portion **162** in the Z direction is set similarly to the tip end portion **162**.

In the tube holding member **160**, the tube **120** is arranged in a similar manner to a case where the tube holding members **130**, **140**, and **150** are used.

In the tube holding member **160**, the tip end portion **162** extends in the Y direction, and thus the position where the tube **120** is held is easily adjusted in the Y direction. In this manner, the length of the movable area **120**F of the tube **120** and the like are likely to be adjusted.

[Fourth Modification Example of Tube Holding Member]

FIG. **8** is a view illustrating a tube holding member **170**.

The tube holding member **170** is a modification example of the tube holding members **130**, **140**, and **150**. The tube holding member **170** can be used instead of the tube holding members **130**, **140**, and **150**.

A tip end portion **172** of the tube holding member **170** has the same shape as the tip end portion **132**. The tip end portion **172** may have the same shape as the tip end portions **142** and **152**.

A base end portion **171** of the tube holding member **170** is formed to have a flat plate shape and to extend in the up direction (+Z direction) and the right direction (−Y direction). The base end portion **171** is formed into an L shape.

An extending site **171***f* of the base end portion **171** that extends in the right direction (−Y direction) extends to an end portion of the paper discharge frame **101**, while in close contact with the front surface **101***s* of the paper discharge frame **101**, and abuts against the side frame portions **64***b*. The tip end portion **172** of the tube holding member **170** is arranged to coincide with the center of the paper discharge frame **101** in the right-and-left direction.

In the tube holding member **170**, the tube **120** is arranged in a similar manner to a case where the tube holding members **130**, **140**, and **150** are used.

In the tube holding member **170**, the tip end portion **172** coincides with the center of the paper discharge frame **101** in the right-and-left direction, and thus a position of the tip end portion **172** in the Y direction does not have to be adjusted. In this manner, the length of the movable area **120**F of the tube **120** and the like can be set to be constant.

The length of the extending site **171***f* can be appropriately changed in design according to the type of the tube and the like.

[First Modification Example of Base End Portion]

FIG. **9** is a view illustrating a first modification example of the base end portion **131** of the tube holding member **130**.

The base end portion **131** of the tube holding member **130** may be fixed in close contact to the front surface **101***s* of the paper discharge frame **101** via an adhesive and a two-sided adhesive tape. In this case, the mounting can be more facilitated than in a case where a screw or the like is used.

A similar fixing method can also be used for the tube holding members **140**, **150**, **160**, and **170**.

[Second Modification Example of Base End Portion]

FIG. **10** is a view illustrating a second modification example of the base end portion **131** of the tube holding member **130**.

A bent portion **131***b*, which is bent by 90 degrees along a back surface **101***b* from the front surface **101***s* of the paper discharge frame **101**, is formed in the base end portion **131** of the tube holding member **130**.

The base end portion **131** and the bent portion **131***b* are fixed in close contact to the front surface **101***s* and the back surface **101***b* of the paper discharge frame **101**. An adhesive and a two-sided adhesive tape are arranged between the paper discharge frame **101**, and the base end portion **131** and the bent portion **131***b*. In this manner, the position of the tip end portion **132** of the tube holding member **130** in the Z direction is accurately determined.

A similar fixing method can also be used for the tube holding members **140**, **150**, **160**, and **170**.

[Third Modification Example of Base End Portion]

FIG. **11** is a view illustrating a third modification example of the base end portion **131** of the tube holding member **130**.

A groove portion **102**, which is open in parallel with the Y direction, is formed in the front of an upper surface of the paper discharge frame **101**.

The base end portion **131** of the tube holding member **130** is inserted from above into the groove portion **102**. Then, the screw **135** that is mounted on the front surface **101***s* of the paper discharge frame **101** is rotated, and the base end portion **131** is pressed against and fixed to a wall surface of the groove portion **102** with a screw tip of the screw **135**.

The tube holding member **130** can be adjusted in position in the Y direction along the groove portion **102**. The base end portion **131** can be fixed to the paper discharge frame **101** after adjusting the position of the tube holding member **130** into an optimal position.

[Fourth Modification Example of Base End Portion]

FIG. **12** is a view illustrating a fourth modification example of the base end portion **131** of the tube holding member **130**.

A second base end portion **133**, which is parallel with the base end portion **131**, is formed on a front surface side of the base end portion **131** of the tube holding member **130**. In addition, a screw hole is formed in the second base end portion **133**. Then, a wall portion of the groove portion **102** on the front surface **101***s* side is pinched between a screw tip of a screw **134** inserted into the screw hole and the base end portion **131**. In this manner, the tube holding member **130** can be easily fixed to the paper discharge frame **101** without having to form a screw hole in the paper discharge frame **101**.

A similar fixing method can also be used for the tube holding members **140**, **150**, **160**, and **170**.

The shapes, combinations, and the like of the respective components illustrated in the embodiment described above are an example, and various modifications are possible, based on design requirements and the like, within the scope of the invention.

In an alternative configuration, the ink may be directly supplied from the ink containers **110** via the tube **120** without the ink cartridge adapters **84** being mounted on the carriage **81**.

The apparatus that includes the ink containers **110** is not limited to the liquid ejecting apparatus but may be any apparatus that consumes a liquid.

Second Embodiment

A multifunction printer according to a second embodiment of the invention will be described.

FIG. **13** is an external perspective view of a printer **201** where a scanner unit **203** is in an open state. FIG. **14** is a side sectional view illustrating an internal structure of a printer unit **202**. The printer **201** is configured as a so-called multifunction printer that has the scanner unit **203** in addition to the printer unit (image recording device) **202**. The scanner unit **203** is arranged in an upper portion of the printer unit **202**, and the printer unit **202** and the scanner unit **203** are integrally configured.

An operation panel (panel body) **205**, which has a button group **204** that is an operation unit by which both of the units are operated, is disposed on a front surface of the printer unit **202**. A liquid crystal display unit **259** that displays setting information and the like is arranged in the operation panel **205**. However, the liquid crystal display unit **259** is optional.

The scanner unit **203** is rotatably supported by the printer unit **202** via an opening/closing mechanism **206** in a rear end portion, and covers the upper portion of the printer unit **202** in

an openable and closeable manner. In other words, when the scanner unit **203** is lifted in the direction of rotation, an upper surface opening portion **207** of the printer unit **202** is exposed, and an inner portion of the printer unit **202** is exposed via the upper surface opening portion **207**.

The upper surface opening portion **207** is closed by the scanner unit **203** when the scanner unit **203** is lowered in the direction of rotation and is mounted on the printer unit **202**. A user can have access from the upper surface opening portion **207** to the inner portion of the printer unit **202** by opening the scanner unit **203** and exposing the upper surface opening portion **207**, and can perform a treatment such as the prevention of the paper jamming.

An ink tube **224** as a liquid supply tube that supplies the ink from an ink tank **223** to a printing unit **222** is divided into two groups of ink tubes **224S1** and **224S2**, and is drawn to an outer portion of a casing of the printer unit **202**.

The scanner unit **203** has an upper frame **208** that forms the casing, an image reading unit (not illustrated) that is accommodated in the upper frame **208**, and an upper lid **210** that is rotatably supported in the upper portion. The scanner unit **203** has a manuscript table (not illustrated), and an object to be read can be mounted on the manuscript table. The scanner unit **203** has a scanner carriage that has an image sensor, a carriage driving mechanism, a control unit that controls each driving site, and the like (all not illustrated). The image sensor of the scanner carriage is relatively moved, by the carriage driving mechanism subjected to the control by the control unit, with respect to the object to be read which is mounted on the manuscript table. The object to be read is read in this manner.

The printer unit **202** has a transport mechanism **221** that transports a sheet of the recording paper P (printing paper and cut paper) as the recording medium along a transport path **220**, the printing unit (recording unit) **222** that is arranged above the transport path **220** and performs the ink jet type printing processing on the recording paper P, the ink tank **223** as a liquid accommodation tank where the ink as a recording liquid which is supplied to the printing unit **222** is stored, the ink tube **224** as the liquid supply tube that supplies the ink from the ink tank **223** to the printing unit **222**, the panel type operation panel **205** that is arranged on the front surface, an apparatus frame **225** that is a frame body which supports the transport mechanism **221**, the printing unit **222**, and the operation panel **205**, and an apparatus housing (housing) **227** that is the casing which covers the transport mechanism **221**, the printing unit **222**, the ink tank **223**, the ink tube **224**, the operation panel **205**, and the apparatus frame **225**. An outlet **226** is arranged in the apparatus housing **227**. The apparatus frame **225** is arranged in the apparatus housing **227**. The ink tank **223** is arranged outside the apparatus housing **227**, that is, outside the printer **201**. In addition, a USB port (not illustrated) and a power supply port (not illustrated) are arranged in a rear surface lower portion. In other words, the printer **201** is configured to be connectible to a computer and the like via the USB port.

The printing unit **222** has a guide frame **228** formed of a sheet metal that is supported by the apparatus frame **225** and extends in full width in a Y axis direction, a carriage unit **229** that is reciprocally supported by the guide frame **228**, and a carriage moving mechanism **230** that allows the carriage unit **229** to reciprocate along the guide frame **228**. An ink head **231** as a recording head is mounted on the carriage unit **229**.

The guide frame **228** is formed to have a "C"-shaped cross section, and an engaging slider portion **232** of the carriage unit **229** is engaged with the guide frame **228** in upper and lower parts thereof. In this manner, the carriage unit **229** is supported by the guide frame **228** in a hooked and cantilevered manner and reciprocally in a direction of extension (Y axis direction), that is, slidably. The carriage moving mechanism **230** has a timing belt **233** that extends along the guide frame **228**, a driving pulley (not illustrated) and a driven pulley **234** across which the timing belt **233** is laid, a connecting/fixing unit (not illustrated) that connects the timing belt **233** to the carriage unit **229** (carriage **235**), and a carriage motor (not illustrated) that drives the driving pulley. When the carriage motor is in forward and reverse rotation, the carriage unit **229** reciprocates in the Y axis direction (right-and-left direction) via the timing belt **233**. This reciprocation causes the ink head **231** of the carriage unit **229** to be in discharge driving, and the so-called main scanning is performed.

The carriage unit **229** has the box-shaped carriage **235** that is reciprocally supported by the guide frame **228** via the engaging slider portion **232**, the ink head **231** that is integrally incorporated into a lower surface of the carriage **235**, and four ink storage portions **236** that are mounted on the carriage **235**.

The ink tank **223** and the ink storage portions **236** are connected via the ink tube **224**, and the ink that is stored in the ink storage portions **236** is supplied to the ink head **231**. In other words, the ink in the ink tank **223** is supplied to the ink head **231** via the ink tube **224** and the ink storage portions **236**. The ink head **231** has four nozzle columns (not illustrated) that discharge the ink droplets of the four colors.

The ink tank **223** has individual tanks, which correspond to the four nozzle columns, respectively and individually storing the ink of the four colors. The ink tube **224** is configured such that four tube parts (not illustrated) are in parallel, and connects the individual tanks of the ink tank **223** for the respective colors one to one to the respective ink storage portions **236**.

The respective ink storage portions **236** are connected one to one to the four nozzle columns of the ink head **231**. Accordingly, the ink in the respective individual tanks of the ink tank **223** is supplied to the corresponding nozzle columns of the ink head **231** via the corresponding tube parts and the respective ink storage portions **236**.

In the printer **201** according to this embodiment, the supply of the ink from the ink tank **223** to the ink head **231** is performed via the ink storage portions **236**. However, the ink tube **224** may be configured to be directly connected to the ink head **231**, not via the ink storage portions **236**. In addition, the number of the colors of the ink is not limited to four, and may be less than four, or five or more. The number of the ink tubes that constitute the ink tube **224** and the number of the ink storage portions **236** correspond to the number of the colors of the ink. The four nozzle columns of the ink head **231** extend in parallel with each other and in an X axis direction, and are arranged downward, with a predetermined paper gap present, with respect to the recording paper that is fed.

In the carriage unit **229**, a flexible flat cable (hereinafter, referred to as FFC) **238** to which the FFC **238** as a signal line is connected connects the ink head **231** to the control unit (not illustrated) that performs driving control on the ink head **231**. In addition, the FFC **238** sends information relating to the amount of the ink stored in the ink storage portions **236** to the control unit. A driving control signal is sent from the control unit to the ink head **231** via the FFC **238**, and the ink head **231** ejects the ink droplets based on the driving control signal. The FFC **238** is arranged behind the ink head **231**, that is, on the side opposite to the side where the outlet **226** is arranged across the carriage **235**.

The transport mechanism **221** has a paper tray **239** as a recording medium loading portion where the recording paper P is set in left alignment, a separation roller **240** that feeds out

the recording paper P from the paper tray **239** by separating the recording paper P sheet by sheet, a paper feed roller **241** that is positioned on the downstream side of the separation roller **240** and feeds the recording paper P into the printing unit **222** along the transport path **220**, a platen **242** that is positioned on the downstream side of the paper feed roller **241** and faces the ink head **231**, a serrated guide roller **243** that is positioned on the downstream side of the platen **242**, and a paper discharge roller **244** that is positioned on the downstream side of the guide roller **243** and feeds the recording paper P out of the outlet **226**. The paper tray **239** has a guide member **239**A that guides a left end edge of the recording paper P. Each of the paper feed roller **241**, the guide roller **243**, and the paper discharge roller **244** is configured as a transport roller that transports the recording paper P, which is separated from the paper tray **239** by the separation roller **240**, forward.

The paper feed roller **241** is configured as a nip roller that is formed from a lower side paper feed driving roller **241**A and an upper side paper feed driven roller **241**B. Likewise, the paper discharge roller **244** is configured as a nip roller that is formed from a lower side paper discharge driving roller **244**A and an upper side paper discharge driven roller **244**B. In addition, the guide roller **243** and the paper discharge driven roller **244**B are supported in a roller frame **245** that is independent of the apparatus frame **225**, and constitute a roller assembly **246**.

The paper feed roller **241** functions as a main roller that controls the feeding (vertical scanning) of the recording paper, and the paper discharge roller **244** functions as a tension roller that applies tension to the recording paper which is positioned on an upper side of the platen **242**.

The recording paper that is fed in from the paper tray **239** by the separation roller **240** is intermittently fed (vertical scanning) forward on the platen **242**, by the paper feed roller **241**, toward the paper discharge roller **244**. In synchronization with the intermittent feeding, the carriage unit **229** selectively discharges the ink (main scanning) while reciprocating in the right-and-left direction to perform the desired printing. The leading edge of the recording paper P that reaches the guide roller **243** beyond the platen **242** is fed into the paper discharge roller **244** with the cambered state corrected by the guide roller **243**. When the printing is completed, the recording paper P is fed out forward from the outlet **226** by the paper discharge roller **244** in this manner.

The ink tube **224** may be configured to be held by a tube support rod **295** that is illustrated in FIG. **14**. The tube support rod **295** may be configured to be provided in the roller frame **245**. When the ink tube **224** is supported from below by the tube support rod **295**, the drooping of the ink tube **224** can be suppressed and a collision between the ink tube **224** and a structure in the apparatus housing **227** and a failure in the transport of the recording paper P can be prevented. The tube support rod **295** has a tube holding unit **296** that has a tip end portion which is divided into two. The ink tube **224** is fitted inside the tube holding unit **296**, and is held not to fall downward.

A position where the tube support rod **295** supports the ink tube **224** is not particularly limited. However, since the tube support rod **295** is arranged substantially at the center of the width of movement of the carriage **235** in a main scanning direction, a movement of the part of the ink tank **223** resulting from the movement of the carriage **235** is suppressed by the tube support rod **295** of the ink tube **224**. In this manner, an irregular movement of the ink tube **224** in an inner portion of the apparatus housing **227** can be prevented.

The liquid ejecting apparatus that ejects the liquid such as the ink has been described as an example of the liquid ejecting apparatus. However, the invention can also be applied to other liquid ejecting apparatuses that eject or discharge a liquid other than ink. Examples of the liquids that can be ejected by the liquid ejecting apparatuses include a liquid in which functional material particles are dispersed or dissolved and a gel type fluid.

The liquid that is ejected from the liquid ejecting apparatus is not limited to the ink, and liquids responding to certain applications can be applied as the liquid that is ejected from the liquid ejecting apparatus.

REFERENCE SIGNS LIST

1 Multifunction printer (liquid ejecting apparatus)
2 Printer unit (liquid ejecting apparatus main body)
10 Upper surface opening portion
66 Groove-shaped concave portion
75 Flexible cable
81 Carriage
83 Ink jet head (liquid ejecting head)
84 Ink cartridge adapter
99 Auxiliary roller (roller)
101 Paper discharge frame (paper discharge frame)
101*s* Front surface
101*b* Back surface
102 Groove portion
110 Ink container (liquid accommodating body)
120 Tube (liquid supply tube)
120F Movable area
121 Tube
125 Tube fastening/fixing tool
130 Tube holding member
131 Base end portion
131*b* Bent portion
132 Tip end portion
140 Tube holding member
142 Tip end portion
150 Tube holding member
152 Tip end portion
160 Tube holding member
161 Base end portion
162 Tip end portion
170 Tube holding member
171 Base end portion
171*h* Extending site
172 Tip end portion
P Recording paper (recording medium)
R Transport path

The invention claimed is:

1. A liquid ejecting apparatus comprising:
a liquid ejecting apparatus main body that ejects a liquid from a liquid ejecting head which is mounted on a carriage toward a recording medium;
a liquid accommodating body that is arranged in an external area of the liquid ejecting apparatus main body; and
a plurality of liquid supply tubes that guide the liquid which is fed from the liquid accommodating body where the liquid is accommodated toward the liquid ejecting head and include a deforming movable portion which is deformed in response to the movement of the carriage,
a paper feed roller that is disposed upstream of the liquid ejecting head,
a paper discharge roller and an auxiliary roller that are disposed downstream of the liquid ejecting head,
wherein the liquid ejecting apparatus further comprises a paper discharge frame that is arranged along a scanning direction of the liquid ejecting head on a further down-

stream side of the recording medium in a transport direction than the liquid ejecting head,

wherein the paper discharge frame supports a plurality of the auxiliary rollers that press a surface of the recording medium, and

wherein the liquid ejecting apparatus further comprises a tube holding member with a base end portion fixed to the paper discharge frame and a tip end portion where a part of the liquid supply tubes is held.

2. The liquid ejecting apparatus according to claim **1**,

wherein the liquid supply tubes are formed from a plurality of tubes, and

wherein the liquid supply tubes are arranged in a horizontal direction and fastened by the tip end portion.

3. The liquid ejecting apparatus according to claim **1**,

wherein the liquid supply tubes are formed from a plurality of tubes, and

wherein the liquid supply tubes are arranged in a perpendicular direction and fastened by the tip end portion.

4. The liquid ejecting apparatus according to claim **2** or **3**,

wherein the liquid supply tubes are parallel connection tubes where the plurality of tubes are connected in parallel.

5. The liquid ejecting apparatus according to claim **1**,

wherein the tip end portion of the tube holding member is formed in parallel with the paper discharge frame.

6. The liquid ejecting apparatus according to claim **1**,

wherein the base end portion of the tube holding member has an extending site along the paper discharge frame, and

wherein the extending site coincides with an end portion of the paper discharge frame.

7. The liquid ejecting apparatus according to claim **1**,

wherein the paper discharge frame further includes a bottom surface that faces the recording medium and a front surface toward the downstream side in the transport direction, and

wherein the base end portion of the tube guide member is fixed to the bottom surface and the front surface of the paper discharge frame.

8. The liquid ejecting apparatus according to claim **1**,

wherein the paper discharge frame further includes a front surface toward the downstream side in the transport direction, and

wherein the base end portion of the tube holding member is formed into a flat plate fixed only to the front surface of the paper discharge frame.

9. The liquid ejecting apparatus according to claim **1**,

wherein the paper discharge frame further includes a groove portion with an open upper surface, and

wherein the base end portion of the tube holding member is accommodated in the groove portion to be movable in the scanning direction.

10. The liquid ejecting apparatus according to claim **9**,

wherein the base end portion of the tube holding member is pressed against the groove portion and is fixed to the paper discharge frame by a screw which is mounted on the groove portion.

11. The liquid ejecting apparatus according to claim **1**, wherein the tube member is disposed in an internal space on the further downstream side of the recording medium in the transport direction than the paper discharge frame.

12. The liquid ejecting apparatus according to claim **1**,

wherein the liquid supply tubes are fixed in a concave portion that is formed in an upper surface of the liquid ejecting apparatus main body.

13. The liquid ejecting apparatus according to claim **12**,

wherein a tube fixing member is mounted on the concave portion.

14. The liquid ejecting apparatus according to claim **13**, wherein a height position of the tip end portion and the tube fixing member are substantially the same height.

15. A liquid ejecting apparatus comprising:

a liquid ejecting apparatus main body that ejects a liquid from a liquid ejecting head which is mounted on a carriage toward a recording medium;

a liquid accommodating body that is arranged in an external area of the liquid ejecting apparatus main body; and

a plurality of liquid supply tubes that guide the liquid which is fed from the liquid accommodating body where the liquid is accommodated toward the liquid ejecting head and include a deforming movable portion which is deformed in response to the movement of the carriage,

a paper feed roller is disposed an upstream of the liquid ejecting head,

a paper discharge roller and an auxiliary roller that are disposed downstream of the liquid ejecting head,

wherein the liquid ejecting apparatus further comprises a paper discharge frame that is arranged along a scanning direction of the liquid ejecting head on a further downstream side of the recording medium in a transport direction than the liquid ejecting head,

wherein the paper discharge frame supports a plurality of the auxiliary rollers that press a surface of the recording medium, and

wherein the liquid ejecting apparatus further comprises a part of the tube fixed to the paper discharge frame.

16. The liquid ejecting apparatus according to claim **15**, wherein the liquid supply tubes are fixed in a concave portion that is formed in an upper surface of the liquid ejecting apparatus main body.

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